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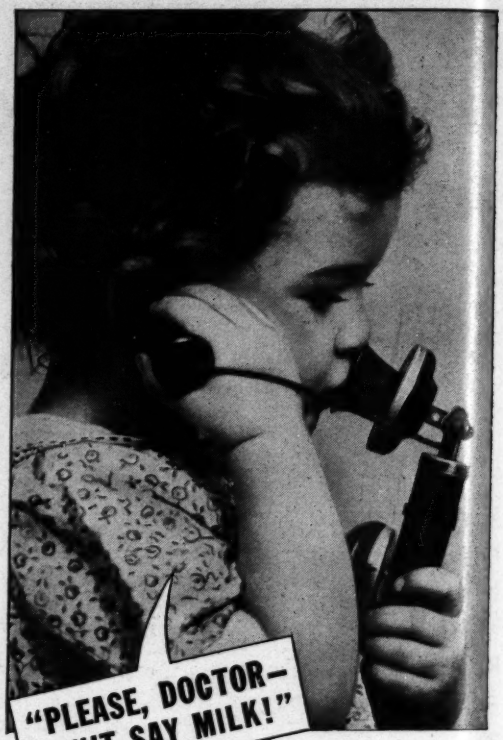

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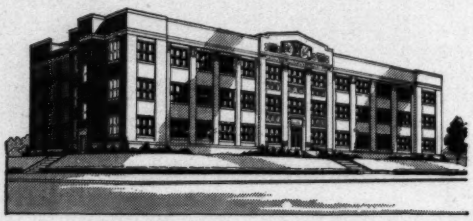

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THE HISTORY AND PROGRESS OF MEDICINE

JOSEPH S. McDANIEL M. D.
Dover, Del.

There is probably no more fascinating story than that of the rise of scientific medicine. Its beginnings were in mystery and superstition; its progress encumbered with ignorance and quackery. Above these it has risen to become the most beneficent science of the modern world.

The story of medicine is that of a long and difficult struggle with the mysteries of life; a struggle which has brought about astounding achievements in the prevention and cure of disease, amelioration of human suffering, and prolongation of life.

In the past, medicine had its place only at the bedside of the individual patient. Today medical science has transcended these narrow limits and has become a guiding force in modern civilization. In becoming such, medicine has enlisted to its aid every agency of our society, even the participation of the individual citizen.

It would be impossible for me to cover in my alloted time very much of the subject relating to the progress of medicine by starting with the primitive man and showing in detail the slow progress through the various centuries up until the nineteenth, and then the many advances from the beginning of the nineteenth to the present time. Therefore, I will only try to mention the high points and the most important steps.

The healing methods that thousands of years ago sprang up and were developed by one group of primitive savage people were of the same type as those developed by all others. In principle they are the same kind that are practiced today by native people in the fastnesses of Africa and in all remote and uncivilized regions.

For primitive or ancient medicine is the expression of a philosophy that grows from the natural reactions of all ignorant men placed in hazardous surroundings. In the early days long before civilization had developed savage man was not, as some people believe, a carefree creature living a free and idealistic life in the midst of an abundant Eden. Instead, this ancient ancestor of ours was a terror-driven, ignorant savage facing a hostile world. By day he slunk through the rough woods in search of food, in constant fear of death by stronger men and beasts. In the dark he hid from unseen terrors, and in his nakedness he shivered in the cold of night. He trembled before the lightning and fell prostrate before the thunder. When convulsed in the agony of disease, he hid like a dumb beast. Injured, he crawled to his lair to die of hunger or be murdered by ruthless enemies.

Even as he crouched and shivered in a world to which he was illy suited physically, he sought an explanation for his plight. He was ignorant but he was intelligent. The mere fact that he developed mysteries established him as a man, for no other animal has ever had the intelligence to reason on abstract matters.

The man of primitive times looked upon a world which terrified him. Like a child frightened by darkness he peopled his environment with creatures of his imagination. These intangible reflections of his mind he called spirits and ghosts. For all the phenomena that he could not understand in the world about him these imaginary beings, so he believed, were responsible. One such phenomenon was *disease*.

This is still the belief of the savage man—to prevent or cure the disease the spirits must be controlled; they must be either forced

*Presidential Address, read before the Medical Society of Delaware, Dover, October 9, 1934.

away or bribed to leave. Some individuals among the savages of the tribe were shrewder, cleverer men than the rest; or perhaps they were not quite so normal as the others—a little queer. At any rate they were not well understood by the others, who came to believe that they had power over the spirits, i.e., the mysterious forces that sent the sunshine and the rain, that brought game to the hunter, and gave success in combat. Such a man was the one, then, to whom the others turned for relief from the spirits that brought disease. He was the medicine man. Some were priests as well as doctors. The most general practice of the savage medicine man was a crude variety of what we call today "psycho-therapy," a treatment that has its influence upon the mind of the patient. For example, the medicine man in treating his patient often ostensibly tried to frighten the spirits away. He put on a costume that was bizarre and fantastic. He danced and shouted before his patient, all the while shaking a rattle. As a result of this procedure the patient seemed actually to improve in health. And he did temporarily. But the cause of this improvement was the influence of the patient's mental processes upon his bodily functions. As long as he sincerely believed that the medicine man was driving away the spirits, the pain was eased and anxiety dispelled. He felt better; some were cured. How close this compares with some of the cults today!

So much for the primitive medicine and treatments.

History shows us that the practice of medicine was regulated by the Babylonians as far back as 2250 B. C. One of the most ancient medicines of civilized people of which we have definite knowledge is that of Egypt—the Egypt of 4,000 to 5,000 years ago. Medicine was then a mixture of superstition and religion on the one hand, and practical measures on the other. The ancient Egyptians carried out religious healings by invocations to the Gods; they administered medicinal substances, most of which had no virtue but some few of which did; and they performed surgical operations of a crude sort, such as splinting broken limbs.

But if we look back to the days of early civilizations, Egyptian, Babylonian, Jewish, we can see rising almost imperceptibly above the morass of mystery the beginning of rational medical practices.

There we find some surgery, some well-attested drugs, and most important of all, the *hygiene,* the *preventive medicine,* founded by the ancient Hebrews. But here is a striking fact that shows the earlier stage in the transition of medicine. Although the Jewish people developed a very sound and rational code of hygiene, such was their plane of civilization that, like all medicine of the time, they built this code into their religion. Medicine and religion had not yet separated. Sanitation at their hands became a religious precept; the priests were sanitary police. It was among the ancient Greeks that the earliest principles of scientific medicine were formulated.

Hippocrates separated medicine from religion and then for this new field he supplied a philosophy and an ethics that were destined to be the great guiding influences of future medicine. Hippocrates did not create the medical knowledge of his time; the Egyptians long before the Greeks, had observed symptoms and had found some practical remedies.

The medical knowledge of isolated facts recorded upon their stone tablets often seems fully as great as that which Hippocrates possessed. No doubt it was, but here is the great difference. Hippocrates took empirical knowledge made up of isolated facts and co-ordinated it; he made it into a flexible system. Other men had observed the symptoms of disease, but it was Hippocrates who first sat beside his patients and painstakingly sought out symptoms and recorded them; and these symptoms were to him not an end in themselves but indications of an underlying condition, a struggle between the patient and the disease which affected him. He took clinical case histories. He founded the bedside method which was to become the distinctive attribute of all great physicians. Having recorded the symptoms of his patients, Hippocrates after wide experience was able to define and classify diseases. There he founded the art of diagnosis and prognosis. But throughout all his work his attention was centered upon the patient, not merely upon his symptoms; he dealt with the man as well as with the dis-

ease. He kept in his practice the balanced relation between science and art which was to be the distinguishing quality of all great clinicians in all ages. The descriptions of disease left by Hippocrates were based on keen and careful observation; they stand today as models of their kind. After his time such accurate observations were not again made in medicine for over eighteen hundren years.

After Hippocrates, civilization and medicine both declined and there was very little advancement until the seventeenth century.

The last of the great physicians of the Roman period was Galen, who influenced medicine for centuries more than any other man. He was a skilled physician but his lasting fame rests on the fact that he performed experiments to demonstrate the facts of physiology.

The greatest single contribution to scientific medicine in the Renaissance Period—1453 to 1600—was Vesalius. He was a Belgian, born in the little town of Wesele from which comes his Latin name. He was educated in the University of Louvain. After graduating from the medical school he wanted to do advanced work, but found no facilities at home. For anatomical study the best he could do was to filch the bones of criminals hanged in chains and thus piece together a skeleton. He went to Paris hoping to find better opportunities. His best source of material then but again only bones was the old catacombs in which the Parisians of long ago had buried the bodies of the dead. At the age of about twenty-five years, Vesalius went to Italy and there found abundant material for dissection. He stayed some twenty years in Italy and in 1542 published his famous text book of Anatomy "Fabrica Humani Corporis" which in its first edition has now become one of the Bibliographic treasures of medicine. As the result of this book, he was asked to become the royal physician to Philip II of Spain, who at that time was a great monarch in the world. Vesalius found himself unhappy without opportunities for research work and is said to have attempted a dissection on the body of a nobleman apparently dead but whose heart was still beating when his chest was opened; and in reparation Vesalius made a pilgrimage to the Holy Land but was shipwrecked and perished on the return voyage when he was looking forward to the chair of anatomy at Padua, which he had accepted.

Italy was at this time the great home of graduate education and anatomical development; the most convincing testimony is to be found in the number of Italian names that have become attached to anatomical structures, as for example, Pous Varolii in the brain, the fissure of Rolando, the Vidian canal in the skull, Eustachian tube, the Fallopian tube, the organ of Corti in the ear, Malpighian bodies in the spleen and kidney, Scarpa's triangle, and many others.

The sixteenth and seventeenth centuries saw the development of not only anatomy, the basic science of medicine, but also of pathology the basic science of disease, and physiology the basic science of health.

The greatest medical scientist of the English-speaking countries, William Harvey—1578 to 1657—the discoverer of the circulation of the blood lived about the middle of this period. He was also the greatest medical scientist of his time. His discovery and his research methods had a deeper influence on modern medicine than that of any other man except Vesalius. By experiments and observation he came to the absolute conclusion that the motion of the blood is continuous, going out through the arteries and coming back through the veins, a true circulation. It was his studies and his method of research rather than his conclusions that were of importance for his time and that made Harvey so important a factor for the development of medicine in a scientific way in the generations after his day.

After Harvey, the greatest medical scientist of the seventeenth century and the greatest investigator who took up the use of the microscope was Marcello Malpighi—1628 to 1694—who has been proclaimed the father of histology. He was a physician to Pope Innocent XII. With the inadequate microscope of that time it is marvelous how Malpighi observed details. In embryology he secured clear and definite ideas of such minute details as the aortic arches, the head poles, the neural groove, the cerebral and optical vesicles. His discovery of the capillaries rounded out Harvey's work.

The two great practical medical scientists of the sixteenth century were Paracelsus and Pare, respectively, physician and surgeon. Paracelsus, born the year after the discovery of America, was a Swiss—Aureolus Theophrastus Bombastus von Hohenheim, to use his own ambitious name, from which is said to be derived our word "bombast." He is the founder of chemical pharmacology in therapeutics. In spite of his many faults, for he was conceited and contentious to the last degree, his influence was far-reaching and his services to scientific medicine very real. He thought he knew ever so much more than he really did, but he knew the limitations of his knowledge in many ways. He was a strenuous opponent of the wandering quacks of the time and also of the foolish pretensions of information obtained from inspection of the urine. He believed that nature cured diseases much more than physicians did, he deprecated officious meddling with disease, he introduced mineral baths, and was one of the first to analyze mineral waters. He used opium in the form of laudanum, and mercury, sulphur, iron and arsenic with great success. He wrote on miners' diseases, the first treatise on occupational disease we have, and he was the first to notice relation between cretinism and goitre.

The other great man of the time in medicine, Ambroise Pare, was a barber's apprentice who became an army surgeon and developed into the greatest surgeon of his time. He re-introduced the ligature and discovered that wounds healed better when let alone than when too much fussed with. Gunshot wounds were supposed in this time to be poisoned and boiling oil was poured along the track of them as an antitoxic precedure, but once when Pare's supply of oil gave out on the battlefield and he expected to find the patients who were without it dead or very ill the next day, he found them all in better health than the others. He dared to follow his own observation rather than the tradition in the matter and thus saved many lives and an immense amount of suffering. He knew the limitations of his own powers of healing and used to say in a famous expression of his, "I treated him, but God cured him."

He was an intensely practical man and invented many new surgical instruments. He felt that after he treated a patient surgically it was his business to make life as livable as possible for him. He worked out various prosthetic apparatus for use after amputation, popularized the employment of the truss in hernia, introduced massage for the limbering up of joints after breaks and dislocations, and adopted the use of artificial eyes after eye removal. He described fracture of the neck of the femur and the difficulties of securing union. He recognized the interference with urination following hypertrophy of the prostate, and was probably the first to suggest that flies must be transmitters of infectious disease. In obstetrics his description of podalic version introduced that practice to the profession, and he had the courage to suggest the induction of labor in cases of uterine hemorrhage. He seems to have been the first to suggest syphilis a cause of aneurysm. Nearly every phase of medicine and surgery owes something to him.

In the seventeenth century came the beginning of American medicine. The first hospital in the New World was erected by Cortez in the City of Mexico in 1524, a very beautiful building yet standing. The first hospital in what is now the United States was established on Manhattan Island in 1663.

The first medical writing with regard to America came from Doctor Chanca, who accompanied Columbus on his second voyage and wrote an account of his experience. He described the climate and its relation to health, some of the diseases of the natives, and the various materials, such as cinchona and Indian herb remedies, which they used for curative purposes.

We now come to the history of the eighteenth century. It is true the archives of the Eighteenth Century are not intercalated by many such epoch-making contributions to medical science and art as other centuries, but withal

"Our little systems have their day,
They have their day and cease to be."

and the discovery of vaccination by Jenner towards the close of the eighteenth century, above all other achievements and advancements, renders its place secure for all time in the annals of medicine.

Eighteenth century medicine, in point of time extending from 1700 to 1799, both years included, was dominated by theories and systems, by cults and creeds. Nevertheless, this era was productive of numerous beneficial and lasting reforms in the healing art. Quackery and superstition were gradually being eliminated from medical practice; the royal touch was fast losting its therapeutic efficacy; and witchcraft and astrology were slowly but surely giving way to more humane and more rational explanations as to the theory and causation of disease. The increasing popularity of male obstetricians, the far-reaching influence of practical anatomy and pathology as promulgated by the two Hunters, by Baillie, and by Morgagni and the founding of numerous hospital and medical and scientific bodies throughout England, on the Continent, and in America, all conspired to make the eighteenth century one well worthy of serious consideration by medical historians.

In hurriedly passing over the eighteenth century it seems necessary to mention in the progress of anatomy the two Hunters, Monroe, Douglas, Scarpa and Meckle. In physiology several of the outstanding names are Haller, Reaumer, and Hewson.

Reaumer in a series of experiments upon a pet cat, performed in 1752, succeeded in isolating the gastric juice and demonstrating its solvent effect upon foods, thereby materially advancing the physiology of digestion.

William Hewson, 1739-1774, an English physiologist, achieved distinction through his work on the lymphatics and on the coagulation of blood.

In chemistry, chief among the notable advancements was the influence exerted upon the theory of respiration by the discovery of the four principal gaseous constituents of the atmosphere, viz: carbon dioxide by Black, 1757; hydrogen by Cavendish, 1766; nitrogen by Rutherford, 1772; oxygen by Priestley, 1771.

A good physician must, of necessity, be a good pathologist, and the same remark is applicable to the surgeon. Pathology, that branch of medicine whose object is the knowledge of disease, was cultivated with assiduity in the eighteenth century. The outstanding man in this subject was Giovanni Morgagni, 1682-1771, an Italian anatomist and the founder of pathological anatomy.

In materia medica, therapeutics, and practice of medicine the outstanding men of the eighteenth century were:

John Tennent of Virginia, publishing the first account of Seneca or the Seneca snakeroot, commending it most highly in the treatment of pleurisy, pneumonia, and the bite of the rattlesnake.

The name of William Withering, 1741 to 1799, of Shropshire, England, one of the ablest clinicians of his time, is ever memorable as the pioneer in the correct use of digitalis in affections of the heart. The well-known Dover's Powder, pulvus ipecacuanhae compositus, was introduced into medicine by Captain Thomas Dover.

The first pharmacopoeia to be printed in America was prepared by Dr. William Brown of Virginia, who succeeded Benjamin Rush as Physician-General of the Middle Department. Several new editions were made during the century and included such drugs as ergot, ipecac, tartar emetic, lime water, iron sulphate, tincture of iron, Glauber's salts, sweet spirits of nitre, syrup of aquilla, liquor potassae, aconite, arnica, castor oil, Hoffmann's anodyne, paregoric, etc.

The outstanding physician was Herman Boerhaave, professor of botany, medicine and chimistry at Lyden.

The outstanding surgeon was John Hunter, the younger brother of William Hunter. His studies of tendons laid the foundation for the operation for the cure of club feet. He discovered the "Collateral Circulation of the Blood" one of the most important discoveries in surgery.

The works on hygiene in the eighteenth century relate to gymnastic exercises, to the location of cities and towns and the maintenance of cleanliness therein, to the construction of aqueducts, fountains and sewers, to the segregation of lepers, and the establishment of free baths for the poor.

Ophthalmology already had assumed a conspicuous place among the specialties. A number of excellent contributions were made to the literature; many operations were performed. Unfortunately at this period of medicine charlatans of both sexes also plied their trade as

oculists, in a few instances, with success which seemed incredible.

The nineteenth century was to see the solution of the two most important problems of disease, its basis in the body, cellular pathology as developed by Virchow; and its causation, which Pasteur was to demonstrate as due mainly to microbic activity. Above all it was to see the use of preventive medicine and the reduction of human mortality as the result of the growing control of the infectious and contagious diseases and the development of hygiene and sanitation.

A revolutionary change in medical science was needed; for in spite of the axiom "Be sure to do no harm" physicians were doing more harm than good.

The most characteristic trait of the medicine of the beginning of the nineteenth century was venesection. It was considered that disease was in the blood and that it could be removed by blood letting. Our own President Washington is usually said to have died from diphtheria, but there is some question whether he did not die from exhaustion because of blood letting. The use of the lancet went out and the leech came in. In the year 1833 over forty millions of leeches were imported to France. Calomel and other drastic purgatives followed the fad for bleeding and leeching. The first forty years of the nineteenth century witnessed little of the momentous movement toward modern medicine.

In the decade 1840 to 1850 we find a continuation of the description of diseases with the fidelity that Hippocrates had employed. It is in this period that Carl Basedow described exophthalmic goitre, that William Stokes recorded his classical account of "heart-block," that Thomas Addison wrote on pernicious anaemia, and that Rudolph Virchow commenced his studies that were to be consumated in his great thesis of cellular pathology. In 1843 Claude Bernard founded experimental medicine when he commenced his study of the glycogenic function of the liver.

And during this decade for the first time we turn to America for a great medical discovery. It was the most useful and certainly the most humane that has been made in all the centuries. It was the discovery of a practical anaesthetsic for surgical operations. It was discovered we might say, three times in three different places within a period of four years, Georgia, Connecticut, and Massachusetts. Crawford Long of Georgia, Horace Wells, a dentist of Hartford, Connecticut, who tried nitrous oxide with success in the extraction of a tooth, and William Morton, a student at Massachusetts General Hospital, gave ether during a surgical operation. Before this time, without anaesthetics operations were performed only for urgent necessity; the shrieking patient was held on the table by strong men; the surgeon to the detriment of his skill but in the interest of mercy, was as speedy in his manipulations as was possible.

In 1860-1870 it is difficult to realize that in a decade which was so near to our own time the cause of infection was not known. Men still believed that a miasma, an emanation from marshes, poisoned wounds and caused fevers. When Lister, the English Quaker surgeon, became in 1860 the Professor of Surgery in the University of Glasgow, wound infection was expected in practically every surgical case and the expectation was fulfilled with the most frightful types of septicemia and putrid gangrene. During the Civil War the average mortality after amputation was well above 50%. But there was one exception, and it was this exception that caught Lister's attention. Simple fractures did not lead to pus formation; all other wounds did. Now, the only difference so Lister reasoned, between the open wound and the wound in the simple fracture was that one was exposed to the air and the other was not. Something in the air, then, must cause the infection, that is, the pus and putrification in the open wound. Lister showed that bacteria cause putrification in wounds. Lister attempted to kill the bacteria and keep them out of the wounds and first tried carbolic acid with good results. He thus formed the principle of antiseptis. And when subsequent work showed that much of the infection came not from the air but from the dirty hands of surgeons and wound dressers this antiseptic principle grew into the aseptic principle. Therefore, modern surgery, surgery of the abdomen, the brain, the chest, the joints, dates from this time.

Turning now to the years 1870 to 1880, we come very near to our own times as we finally

reach the decade in which the bacterial cause of infection was established, probably the most far-reaching discovery in all human progress. The work of Pasteur and Koch overshadows all medical events of the time.

The greatest contribution to preventive medicine, the man who saved more lives than any other man who ever lived, was Louis Pasteur. He was a chemist. His work started with the purely lay problem of why wine spoils. He studied fermentation and putrefaction. He was able to show that putrefaction resulted from the contamination and subsequent growth of bacteria. To prevent this bacterial growth he developed the process of heating the fluid, known by his name as "Pasteurization." He also conceived the idea that bacteria were the cause of the various febrile diseases transmitted from person to person. His experiments consequently led to his discovery of the principle of vaccines, and proved their value in anthrax and chicken cholera and rabies. It was in 1882 with the aid of Pasteur's theories that Robert Koch, a member of the German Imperial Health Department, made the momentous discovery of the cause of tuberculosis. During the decade of 1880 to 1890, Koch and Pasteur attracted world attention and there was an active search for all disease bacteria, with the result that the majority of the more important pathogenic organisms were identified—the bacilli of cholera, typhoid, diphtheria, tetanus and meningitis, to name only a few—and it was equally natural that men should seek to protect themselves against bacteria; hence it was in this decade that we have the investigations of bacteria in milk. the first steps toward the pure milk of today, a movement that had enormous influence upon the decline in infant mortality. Sanitation, sewage disposal, and purification of water, measures that make modern urban civilization possible, had purpose given to them as the result of the bacterial discoveries of this and previous decade.

This now brings us up to modern times where most all of you who are listening to me have witnessed the many advances in medicine and surgery, and it is, therefore, not necessary to go into details. You have seen the discovery of the organism of syphilis in 1905 by Fritz Schaudinn, the diagnostic serum test by Wasserman, and the specific treatment by Ehrlich in 1910. You have seen the great achievement and advancement in "organotherapy" which led to the greatest practical result of the isolation of insulin by Banting and Best, and prolonged the lives and reduced the suffering in diabetes. You have watched the research work in the study of vitamines, those necessary food substances that exert an almost hormone-like action in promotion of normal bodily function. And let us pause to record that great discovery of only a few years ago, the one which is associated with the names of Whipple, Minot and Murphy, that the once invariably fatal disease, pernicious anaemia, yields almost miraculously to liver or extract of liver. Our knowledge of anaphylaxis is a development of the twentieth century. You have watched and helped to reduce the mortality rate in tuberculosis, and opened the way for the eradication of a disease which at one time was called the "Captain of the Men of Death."

We are now watching the great effort in cancer research, and let us hope and pray that in a short time we will know the exact cause, prevention, and cure of this much-dreaded condition which is apparently increasing.

What contributions and discoveries in medicine and surgery await us during the next decade no one can tell. However, we have reached a time when we are not surprised. So the physician today aided by science and industry stands, as A. Lawrence Lowell has said, "Upon the prow of the ship of civilization." No longer is he scanning the horizon for the sight of sea monsters and other fabrications of mystery and magic; with chart in hand and scientific instruments of precision at his disposal, he is piloting us towards the peaceful harbor of old age, undisturbed by the terrors which formerly haunted the most intrepid voyager on the sea of life.

With the growth of scientific medicine in the modern time has come, very surprisingly, a development of quackery of many kinds. A great many of our people who have had the benefits of higher education have become devotees of these systems of healings, such as bonesetters and adjustors, respiropaths and other "paths" of the most varied kind. It is

mainly the educated classes who patronize these and not the ignorant, as might be expected. The correction of this "social evil" is manifestly depended on the special education of the intelligent classes in scientific medicine. The medical profession will have to undertake this as one of its duties. Hippocrates said that a physician can sometimes cure, he can nearly always relieve, but he can always console. This third duty is sometimes forgotten in the busy rush of modern medical practice. Patients must be treated as human individuals and not as cases, if we are not to have wanderings to all sorts of healers by educated people who are solicitous and worried over mild or fancied ailments. We have begun to realize the importance of the attitude of mind of people toward their ills, real or fancied. This is one of the most important factors in the production of a symptomatic condition of discomfort and in the cure of these cases. Here lies the next great advance in *applied* clinical medicine.

What made medical progress possible was the gigantic development of the natural sciences. There was extraordinary development at the same time in another field, technology, and the result of this was the industrialization of the modern world. The same elementary force that has made medical progress possible has changed the aspect of the world so profoundly, that the doctor has difficulty in finding his place in this new world, which is ruled by iron economic necessity. The number of doctors grew and a ruthless competition arose. While the doctor of yesterday did not need to bother about his bills, today he has to merchandise his services. He has to appraise the cash value of each service that he performs. The more efficient medicine has become, the more complicated and the more expensive it is, and the more difficult it is for the doctor to give free medical care. Today, therefore, we are in the very serious situation that we run the risk of seeing a great effort wrecked by maladjustment.

Long ago an attempt to deal with this situation was made in Europe by the introduction of social insurance. Sickness insurance was introduced, first in Germany; not by the socialists, but by Bismarck and the conservatives, which is very often overlooked. Sickness insurance is the cheapest way to take care of poor patients, because it makes them take care of themselves, by saving part of their wages for the expense of sickness. There can be no doubt that the sickness insurance in the different European countries has had remarkable results for the health of the people. Germany, soon after a lost war, with famine and revolution added, had health conditions that were just as good as those existing in the victorious countries. And the compulsory sickness insurance is surely responsible for this, to a very large extent. And yet, it is beyond question that the different insurance systems as they are working in Europe today have very serious drawbacks. A new type of medical service was created, which endeavored to preserve the old forms as much as possible. The doctor, in most cases, still was paid according to his individual services, but as the insurance companies had not unlimited means, the fees sometimes were very inadequate. On the other hand, abuses on the part of the patient as well as the physician, occurred, so that both patients and doctors had to be controlled. The result was a huge administrative machinery with endless red tape.

The next step in the development was the one undertaken by Russia, where the whole working population is insured against sickness, and where the same position is given to the physician as the priest, the judge, the teacher, already have in other countries.

We medical men have a strong "esprit de corps". We have a glorious history and we are justified in being proud of it. What unites us is that, unlike other professions, all of us, whether we work at the bedside, in the laboratories, or at the writing desk, have but one purpose, to benefit the sick man. We have developed strong professional organizations, from the very beginning of our history. The Greek physicians and surgeons had their guilds, their codes, and their ethics, were members of their faculties, which were very powerful organizations. From the sixteenth century on medical societies developed and today all over the world are very influential bodies. All this necessarily makes us very conservative, but we must have the courage to face the present-day situation, openly. We have a very absorbing profession from the first day we

enter medical school, and we have to work hard; this leaves us little time to see or to watch what is going on around us. In this way it happens that many of us have not quite realized how fast the world is changing its aspect. There is a strong trend away from individualism. Health and disease are no longer considered a private matter of the individual. In many countries laws have been made to enforce health. Society, more and more, feels responsible for the welfare of all its members. It has placed the means of retaining or regaining health within the reach of every one, and in return, it may well demand health of the individual. We may like this development, or we may dislike it, but we cannot help it. All of us are dependent on each other. If large parts of the population suffer it is quite obvious that the rest likewise will be affected. To us medical men the idea that one sick organ affects the whole organism should be familiar.

There is one lesson that can be derived from history. It is this: that the physician's position in society is never determined by the physician himself, but by the society he is serving. We can oppose the development, we can retard it, but we will be unable to stop it.

The development of medicine has reached a crucial point. It is our duty to save the efficiency of a noble profession, which has had not only a great past but gives promise of a still greater future. Never before has society presented the physician with so wide a field of activity and with so much potential power.

Now in closing, I wish to mention an important problem that we physicians must face:

About five years ago a committee was formed to study the "High Cost of Medical Care." This committee spent a million dollars, which had been supplied by the Millbank and other funds. At first glance such a study seemed justified for we have seen how hard it has been for some families to meet the expenses of long illness. But this study has shown that the average family's annual medical bill in this country is much less than the bill for luxuries such as cosmetics, chewing gum, and candy. The figures of $150 against $674 have been given. The difference is that the money for luxuries is spent in small sums day by day and seems no hardship, while the bill for medical service comes in a lump sum. Out of this study has come a "majority report," signed by social workers who have a socialistic trend, and eminent physicians who are largely out of touch with the relations of general practitioners; and a "minority report", signed by men who know our problems and point of view. Much discussion and even agitation have developed over the merits of these plans. The American Medical Association and many State societies have approved the "minority report" and are vigorously opposing the solutions offered by the "majority report." Without going into details or discussing the merits of the plans which have been offered, I must point out to you the one thing we must face. That is the effort of the Millbank and Rosenwald Foundations to introduce some form of "State medicine" by legislation, as suggested by the "majority report." The plans are patterned after the British and German sickness insurance laws. Both of these have worked to the disadvantage of physicians, and have not improved the service to the patient. They have substituted quantity service for quality service, and have broken down the fine personal relation which exists here between physician and patient. Any plan to meet the cost of sickness, whether it be by budgeting, weekly saving as in Christmas funds, or such, will be desirable. All efforts to care for the indigent sick and disabled must be continued. But the management and control of medical practice *must not* fall in the hands of the State officials. There is evidence that bills will be offered to many Legislatures in the next session to institute such forms of practice.

We must be prepared to oppose such measures. I, therefore, recommend that our Committee on Legislation be urged to take up this matter and be prepared to oppose any such legislation as may be presented to our Legislature.

Delaware Academy of Medicine

Surgical Conferences—First Friday, at 8:45 P. M.

Pathological Conferences—Third Friday, at 8:45 P. M.

IMPAIRMENT OF HEPATIC CARBOHYDRATE FUNCTION ESTIMATED BY LEVULOSE AND GALACTOSE*

By ROBERT W. TOMLINSON, M. D.**

(Concluded from last Month)

SUMMARY (2)

While Spence and Brett's figure of a rise of 20 mg. per cent as the commencement of hepatic insufficiency is undoubtedly correct in many instances, it cannot be safely applied at all levels. One can have more confidence in the test, by having higher absolute standards and by reading the range just below these, as suspicious. If, however, the reading for the first and second hours are both suspicious, one can feel justified in calling the test positive. This range of suspicion must vary according to the fasting level, as it is evident that there is a marked difference of behavior, according to the level of the fasting sugar. This amount of grace and variation from strictly normal limits may be allowed. Fewer normals, however, than early cases of genuine hepatic pathology, lie within this range. While, therefore, the standards given have a full margin of safety, they have also an elasticity, which takes variations in blood sugar level in full consideration. It is to be kept in mind in grading, that the levels of blood sugar which continue elevated through the second hour have particular importance, signifying as they do, continuing inability of the liver to handle sugar. A curve which rises in the second hour above the level of the first, means serious hepatic insufficiency provided the first hour elevation is sufficient to prove that absorption is satisfactory.

It has been observed that levulose yielded positive evidences of hepatic dysfunction in cases of entamoeba—hystolytica, cirrhosis of the liver, alcoholism, biliary disease, cholangitis, syphilis and cardiac disease.

GALACTOSE

Galactose differs from levulose in that the former is assimilated very imperfectly, whereas the assimilation limits of the latter are so high that they can scarcely be exceeded. Fructose is on a par with glucose as a glycogen former; galactose is not; but, if glycogen formation in the liver were the chief factor by which the accumulation of the absorbed sugar in the blood is prevented, then galactose should be immensely more effective even than glucose in raising the level of the blood sugar. (8).

The administration of galactose as a means of diagnosing liver abnormalities and also for estimating liver efficiency has been largely confined to the German clinics. Like glucose, it is a Monosaccharide, and is absorbed direct by the portal circulation into the liver. In health the ingestion of forty gm. results in no hyperglycemia, and no galactose appears in the urine, as the glycogenetic capacity of the liver is sufficiently powerful to transform the injested sugar into glycogen, with the passage of but small amounts into the peripheral circulation, and in consequence, only a small increase, if any, in the blood sugar value. It must, however, be administered in a pure state before any reliance can be placed on the results obtained. (10).

The metabolism of galactose is performed primarily with the co-operation of the liver and not with other tissues, and while it is not asserted that galactose is always sure, in so far as the investigators know, galactose metabolism depends not only on the condition of the liver, but also on the capacity of other tissues. The galactose and levulose tests do not agree in one third of all cases of hepatic disorders. In some cases the levulose test in the presence of a positive galactose test is slightly positive or completely negative. (14).

It has been shown that while the general tendency of liver disease is to depress the galactose tolerance, a certain number of cases is found, in which an apparently uncomplicated liver derangement is associated either with a normal or even increased power to utilize this sugar. (18).

Shay, Schloss and Rodis have concluded that galactose offers the best method of investigating the carbohydrate function of the liver, but do not consider it adequate as a routine test for liver function, but on the contrary view its limitations as definite. The superiority of galactose over levulose in testing liver function is based on the urinary output

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of galactose since this appears to serve as the best measure of the utilization of galactose by the liver. (4).

In the studies of galactose similar methods were utilized as in the previous work. With the dosage of galactose injected intravenously, about twenty to thirty per cent of the sugar was recovered in the urine. Following complete removal of the liver, similar injections of galactose are followed by an excretion of more than eighty per cent of the sugar injected. If excretion is prevented by performance of bilateral nephrectomy, galactose remains in the blood several hours longer. Symptoms of hypoglycemia are not influenced by administration of galactose in the liverless animal. The liver appears entirely responsible for the conversion of galactose to glucose.

There are numerous difficulties involved in the interpretation of functional tests in which galactose is used. That intestinal administration of galactose to hepatectomized animals shows a loss (oxidation?) of large amounts of galactose in different animals was readily demonstrated. Uniform dosages of galactose administered intravenously in dogs with extensive cirrhosis of the liver, showed a much greater excretion of galactose than occurred in normal animals. However, extensive hepatic injury must be present, before any marked deviation from the normal response can be detected. This finding may be indicative of the extensive reserve function the liver is known to possess. (19).

It must be evident that the actions of galactose and levulose are fundamentally different. Galactose is absorbed with rapidity, and has but a five per cent utilization by the liver, and very little by the muscles, about fifty per cent of it is excreted by the kidneys, and Shay, Schoss and Bell state that an analysis of the urine makes a very satisfactory test, which may be utilized even in diabetes, because the galactose may be determined independently of the glucose. (2).

Standards of Galactose Tolerance Test

There is a difference of opinion about the output of galactose, which should be accepted as normal after the administration of 40 gm. of the sugar.

I. Bauer tabulated his findings as follows:

(a) Normal 0-1 gm.
(b) High normal 1-2 gm.
(c) Positive 2-3 gm.
(d) High positive 3-12 gm.

II. The greatest loss that has been observed in this series is 6.5 gm. (Davies 1927), who has concluded that any amount of over 2 gm. indicates a definite hepatic deficiency.

III. Shay and Schloss (1931) considered an output of more than 3.0 gm. of galactose in the five-hour period, following the administration of 40 gm. of galactose, as indicative of impaired liver function.

The Galactose Test

Summarizing the pathological states, it is seen in obstructive jaundice the galactose test is negative, while in toxic and infective jaundice (including the hepatitis called catarrhal jaundice), and in any other lesion of the hepatic cell the following is the salient feature, "a loss of over 2 gm. in the urine." (10).

In cases of jaundice due to factors other than acute diffuse damage of the liver cells, sufficient active liver tissue is present to carry on carbohydrate metabolism. Thus obstructive or haemolytic jaundice gives readings within the normal range. On the other hand, in jaundice accompanying acute diffuse damage of the liver cells, the carbohydrate function is impaired, and the liver, unable to utilize the normal quantity of galactose, allows a quantity of this sugar, larger than normal, to pass and reach the general circulation. In the absence of a kidney threshold for galactose, this excess appears in the urine. Hence, in jaundice with sufficient damage of the liver cells, quantities of galactose greater than three gm. appear in the urine, in the five hours following the ingestion of forty gm. of this sugar. Cases of chronic damage of the liver cells (tumor, cirrhosis, etc.) it must be remembered, can also reach the state, in which the carbohydrate function of the liver may show impairment.

The point that it is desired to make becomes obvious that under any condition in which the liver reserve for carbohydrate function is destroyed, there will be an abnormal galactose tolerance. All of the various conditions in which a high galactose out-

put is reported, fall in the group in which diffuse damage of the liver cells, of an acute nature, has occurred. Catarrhal jaundice is most frequently reported, while arsphenamine jaundice, acute yellow atrophy, phosphorous poisoning, syphilitic hepatitis, and jaundice associated with lead poisoning, as well as the various acute infections, make up the list of other types of cases, in which this test has been found positive.

It is believed that the galactose tolerance test offers a means of identifying early the group of toxic and infectious jaundice, a group of cases that often tax the diagnostic acumen of the keenest clinicians. The basis for the use of a sugar tolerance test in differentiating these groups of cases of jaundice has been described; the differentiation is attributed to the diffuse destruction and derangement of the hepatic cells, with consequent disruption of the carbohydrate mechanism on the one hand and the survival of sufficient functioning tissue, to maintain so vital a process on the other. (21).

TECHNIQUE AND METHODS

In accordance with the holding of Tallerman, expressed under Technique and Methods Employed—the following schemata of procedure, in testing the levulose tolerance of those patients subjected to the experiment, was accepted:

I. After an all-night fast, subsequent to the ingestion of the evening meal, at about 5 p. m. the previous night, specimens of fasting urine and blood were obtained, the urine being voided into a suitable receptacle, and the blood extracted from a vein, and received in an oxalated tube.

II. The patients then swallowed 400 cc of water in which 50 gm. of levulose (made from the Jerusalem artichoke and marketed by Pffanansteil of Waukegan, Illinois, this being the form most free from impurities, and not producing nausea or diarrhea in any of the cases ingesting it) were dissolved.

III. From this time, specimens of blood (about 5 to 10 cc per specimen) were extracted from a vein and received in an oxalated tube every 45 minutes for 5 additional extractions, it being felt that, while antecedent tests reported in the literature had been carried on for a period of two hours only, which had seemed adequate to effect a logical conclusion relative to the cycle of events occurring in such interim, as expressive of the liver's ability to metabolize carbohydrate, it might be of interest to observe the blood levulose readings over one and one-half hours longer, to determine if additional data pertinent to such function might be evinced.

III. Specimens of urine, subsequent to the taking of levulose in amount aforecited, were collected hourly, for five hours.

IV. The blood sugar content of each of the six specimens was then estimated according to the technique described by Folin, Otto and Wu, Haein, Journal of Biological Chemistry, 38, 108, 1919; 41, 367, 1920.

V. The individual urinary specimens were examined separately for levulose and the total gm. output of levulose for the several specimens determined by the method exhibited in the recountal by Summer, J. B., Journal of Biological Chemistry, 62, 2187, 1924, because of a desire to determine the validity of the urinary excretion of levulose, as indicative of hepatic dysfunction in metabolizing carbohydrates, specifically levulose.

VI. The patients tested as to the ability of their liver function as displayed toward the metabolism of levulose, were, one or two days later, after a similar all-night fast, subsequent to the 5 p. m. meal of the evening before, and after voiding a fasting specimen of urine into a suitable receptacle, given 40 gm. of galactose (known to be free from contaminating impurities) dissolved in 400 cc of water, after which at every hour, for five hours, voided specimens of urine were collected in separate suitable receptacles for examination. Each of these specimens was examined for galactose content, and the total gm. of the several specimens was estimated by the technique described by Summer, J. B., Journal of Biological Chemistry, 62, 287, 1924.

VII. The establishment of the validity of the differentiation of levulose from galactose as a result of the last two mentioned methods was effected in the case of:

I. Levulose

(a) By testing with hydrochloric acid.

II. Galactose

(a) By the music acid reaction.

Standards—Normal—Abnormal

I. It was decided, after serious consideration of the standards affecting the results evinced, subsequent to the use of levulose and galactose, as agents of expression of the degree of impairment of the hepatic glycogenic function, as portrayed by Joliffe, Tallerman and Kendall, aforecited, to

(A). Accept the figures of Tallerman, that a rise of thirty (30) mg. above the fasting blood sugar level within the first hour with a failure to return to within ten (10) mg. of the fasting blood sugar level by the end of the second hour be esteemed as indicative of impaired liver glycogen function, and that a rise of the blood levulose of twenty-five (25) mg. within the first hour, and a continuation of such level or its ascent to a higher level by the end of the second hour, should be considered suspiciously indicative of hepatic glycogen dysfunction.

(B). That a rise of the levulosuric index, in gm. total output at the end of five (5) hours, above 0.13 gm. should be looked upon as evidence of lack of normal liver glycogen function.

(C). That a galactosuria exceeding a total output of three (3) gm. at the end of five (5) hours, should constitute positive evidence of deficient hepatic glycogen function, and when the galactosuria totaled in gm. between two and one-half (2.5) and three (3) gm. total output, at the end of five hours (5) such should be interpreted as a suspicious lessening of hepatic glycogen function.

Methods

I. Positive or negative results are depicted by the letters P or M and where both appear, the result was viewed as suspicious. Normal results were indicated by the word normal.

II. By reading the titles of each table, the specific portrayals will be readily appreciated. In order to effect clarity of interpretation, the component sheets of each of the first three tables have been paged in parallel numerical sequence so that, for example, in tabular exhibition of Case One, the blood levulose, urine levulose, urine galactose reactions, with exhibition of test showing greater degree of positivity, diagnosis, treatment and result may be followed rapidly from the beginning of experimentation through the several separate tests.

III. Table IV is a comparative tabulation of the laboratory research in all cases reacting positively to the test agents, levulose or galactose, with the additional recordances of the van den Bergh, bromsulphalein and urobilinogen test results.

IV. Table V depicts through the medium of its left one-half the cases in which levulose alone, and the right one-half the cases in which galactose alone, yielded evidence of hepatic glycogen impairment.

V. Table VI portrays the one case of the series, in which both levulose and galactose reactions attested to lessening of hepatic glycogen function.

VI. Table VII contrasts the positivity of levulose or galactose; depicts the maximum elevation in mg. of blood levulose above the fasting blood sugar level; and contrasts the levulosuria and galactosuria readings of the second hour after the ingestion of fifty (50) gm. of levulose and forty (40) gm. of galactose.

Explanations Relative to Cases and Recorded Diagnoses

Case II. Diagnosis—Pleurisy with Effusion (left).

Presented clinically—Tenderness in right upper abdominal quadrant with the liver palpable three cm. below the right costal margin.

Case VI. Diagnosis—Rheumatic Heart Disease.

Clinically—Heart—marked precordial bulging with every heart beat-apex—3 cm. to the left of the midclavicular line in the sixth interspace, with precordial dullness markedly enlarged, marked systolic and diastolic murmurs, with transmission to the left axilla, loud aortic systolic and diastolic murmurs heard plainly over Erb's point and in the neck along the carotid. Typical Corrigan pulse.

Case VII. Diagnosis—Leg Ulcer

Clinically—Heart—slightly enlarged

to the left. Pulse—irregular in volume. Urobilinogen 1:100—van den Bergh—indirect, 2 mg. per 100 cc. Urine—faint trace of albumin.

Case XLI. Diagnosis—Diffuse Goitre with Hyperplasia.
Clinically — Heart — definite systolic mitral thrill, coarse systolic mitral and aortic murmurs. Urinalysis — faint trace of albumin. Urobilinogen plus up to 1:200—van den Bergh—indirect, 0.3 mg.—Icterus Index 5.

Case XLII. Diagnosis—Exopthalmic Goitre. Clinically—Heart—soft blowing systolic murmur at apex. Bromsulphalein—20%. B. M. R.—plus 49. Albumin—globulin ratio, 1:1.1.

Case XXII. van den Bergh—indirect, 0.8 mg.; direct, 0.5 mg. Bromsulphalein—20%; E. K. G.—Coronary Disease with Myocardial Degeneration.

TABLE I

Tabulation Results Comparatively—Blood Levulose and Urine Levulose

		Blood Levulose							Urine Levulose						
Case No.		Fast	45 min.	90 min.	135 min.	180 min.	225 min.	P or M	Fast	1 hr.	2 hr.	3 hr.	4 hr.	5 hr.	Gm. Output
		mg. 100 cc	mg. 100 cc	mg. 100 cc	mg. 100 cc	mg. 100 cc	mg. 100 cc		Gm.	Gm.	Gm.	Gm.	Gm.	Gm.	P or M
1		77	87	77	70	77	78	M	0.07	0.066	0.056	0.057	0.058		0.304 P
2	(100)	88	102	89	94	99	96	M	0.52	0.375	0.125	0.225	0.36	0.29	1.895
2	(50) (Gms)	72	71	71	81	77	77	M	0.048	0.075	0.072	0.054	0.054		0.303 P P
3	(100) (Gms)	84	100	102	99	99	85	M	0.192	0.200	0.567	1.299	1.4259	0.66	4.3439 P
3	(50) (Gms)	77	116	108	108	112	103	P	0.4	0.465	0.69	0.465	0.2	0.36	2.58 P
4		68	75	81	75	73	79	M	0.320	0.128	0.152	0.08	0.056	0.072	0.808 P
5		83	88	95	83	81	74	M	0.088	0.054	0.112	0.168	0.054	0.828	1.294 P
5		90	109	96	91	88	92	M	0.35	0.68	0.40	0.186	0.534	0.486	2.636 P
6		86	123	103	93	86	82	M	0.309	0.810	0.240	0.276	0.162	0.072	1.871 P
7	(100) (Gms)	66	99	96	95	92	90	M	0.312	0.144	0.632	0.264	0.240	0.120	1.712 P
7	(50) (Gms)	85	90	83	85	89	82	M	0.250	0.270	0.168	0.156	0.240		1.08 P
8		86	90	91	99	106	100	M	0.152	0.130	0.084	0.156	0.210	0.144	0.876 P
9	(100) (Gms)	103	148	142	122	104	103	P	0.088	0.156	0.112	0.140	0.102	0.066	0.664 P
9	(50) (Gms)	99	122	113	96	86	90	M	0.360	0.048	0.081	0.330	0.312	0.196	1.259 P
10									0.186	0.190	0.020	0.045	0.135		0.576 P
11		103	129	144	139	129	118	P	0.440		0.09	0.116	0.128		0.774 P
12		75	85	71	86	69	78	M	0.714	0.2	0.244	0.204	0.246		1.608 P
13		100	118	123	120	108	100	M	0.08	0.15	0.232	0.368	0.248	0.312	1.390 P
14		39	45	36	39	40	38	M	0.165	0.150	0.180	0.330	0.540	0.540	2.105 P
15		50	54	54	49	45	45	M	1.020	0.180	0.255	0.395	0.330	0.420	2.6 P
16		113	113	102	109	109	111	M	0.210	0.232		0.488		0.360	1.29 P
17		89	96	86	86	86	86	M	0.990	0.125	0.180	0.450	0.480	0.480	2.7 P
18		78	92	86	86	83	78	M	0.978	0.08	0.06	0.105	0.03	0.03	1.283 P
19		103	138	117	88	85	68	M	0.144	0.124	0.384	0.680	0.380	0.220	1.932 P

TABLE I (Continued)

20	99	117	132	128	128	125	P	0.152	0.064	0.112	0.112	0.072	0.104	0.616 P
21	99	109	108	97	97	87	M	Did not void any urine						
22	65	144	153	128	113	108	P	Did not void any urine						
23	82	97	100	93	88	70	M		0.560	0.330	1.275	0.540		2.705 P
24	167	146	119	96	86	62	M	0.310	0.924	0.360	0.06	0.560	0.512	3.256 P
25	87	88	96	86	86	83	M	0.032	0.008	0.0144	0.034	0.01		0.0984 M
26	83	83	99	83	69	50	M	0.0192	0.0032	0.0048	0.008	0.0056	0.0076	0.0484 M
27	Unable to secure Venous Blood							0.728	0.105	0.09	0.28			1.2 P
28	79	96	84	77	78	78	M	0.0252	0.196	0.0925	0.0832	0.032		0.4289 P
29	78	81	79	97	100	74	M	0.0500	0.0832	0.0435	0.0352	0.0532	0.0144	0.2794 P
30	71	82	54	78	71	69	M	0.804	0.768	0.378	0.378	0.294	0.408	3.03 P
31	103	128	128	91	83	87	M	0.060	0.040	0.088	0.144	0.128	0.192	0.652 P
32	97	90	112	123	98	91	M	0.212	0.092	0.08	0.16	0.168	0.08	0.792 P
33	82	87	82	85	87	91	M	0.312	0.240	0.16	0.6	0.72		2.032 P
34	81	110	91	90	87	85	M	0.123	0.348	0.420	0.156	0.088	0.084	1.219 P
35	74	79	75	64	70	68	M		0.19			0.2		0.39 P
36	84	96	99	104	97	89	M		0.64		0.04			1.04 P
37	67	96	71	77	68	68	M	0.51	0.432	0.45	0.75			2.142 P
38	79	121	100	92	98	102	P	0.45	0.682	0.225	0.170	0.112	0.1	1.739 P
39	104	136	118	118	104	103	P	0	0.504	0.270	0.390	0.480		1.744 P
40	86	95	95	82	87	88	M	0.093	0.135	0.128	0.675	0.174	0.135	1.34 P
41	Unable to obtain either blood or urine levulose													
42	Unable to obtain either blood or urine levulose													
43	65	67	55	65	60	65	M	2.132		0.12	0.12			2.372 P

TABLE II

	Galactose							Comparative Tabulation Effect Sugar Ingestion									
	Urinary Excretion in Gms.							Blood Levulose		P M	Urine Levulose		P M	Urine Galactose		P M	More Valuable Indicator
Case No.	Fast	1 hr.	2 hr.	3 hr.	4 hr.	5 hr.	Gm Output	Mg 100 cc Maximum			Gm Output			Gm Output			Hepatic Dysfunction
1	Gm	Gm	Gm	Gm	Gm	Gm	P or M	Read.	87								
	2.94	0.34	0.34	0.2	0.52		4.34	Elev.	10	M	0.304		P	4.34		P	Galactose
2	0.732	0.252	1.22	0.640	0.3	0.132	3.276	Read.	102	P	1.895		P				
								Elev.	24								
							P	Read.	81	M	0.303		P	3.276		P	Galactose
								Elev.	9								
3	1.4	1.4	1.36	0.28	0.05		4.49	Read.	102	P	4.3439		P	4.49		P	Galactose
							P	Elev.	18								(100 Gm Levu.)
3	0.74	0.44	1.8	0.72	0.13		3.83	Read.	116	P	2.58		P	3.83		P	Galactose
							P	Elev.	39								(100 Gm Levu.)
3	0.48	1.8	0.64	0.52	0.96		4.4	Elev.	39		Not			4.4		P	Galactose
							P	Elev.	39		Obtained						
4	0.08	0.345	0.18	0.89	0.14		1.635	Read.	81	M	0.808		P	1.635		M	Normal
							M	Elev.	13								

TABLE II (Continued)

5	0.2160	0.128	0.9	0.064	0.075		1.283 M	Read. Elev.	95 12	M	1.294	P	1.283	M	Normal
5	0.544	0.172	0.54	0.576	0.44	0.564	2.936 P	Read. Elev.	109 19	M	2.636	P	2.936	P M	Galactose
6	2.208	1.056	0.564	0.275	0.304		4.407 P	Read. Elev.	123 37	M	1.871	P	4.407	P	Galactose
7	2.352	0.99	1.17	1.2	0.558	0.522	6.832 P	Read. Elev. Read. Elev.	99 33 90 5	P M	1.712 1.08	P P	6.832	M P	Galactose
8	0.14	0.07	0.085	0.07	0.055		0.42 M	Read. Elev.	106 20	M	0.876	P	0.42	M	Normal
9	0.136	0.172	0.172	0.064	0.136		0.68 M	Read. Elev. Read. Elev.	148 45 122 23	P M	0.664 1.259	P	0.68	M	Normal
10	0.09	0.54	0.0456	0.0126	0.0306	0.05	0.7688 M	Not Obtained			0.576	P	0.7688	M	Normal
11	0.72	0.165	0.102	0.184	0.168	0.048	1.415 M	Read. Elev.	144 41	P	0.774	P	1.415	M	Levulose
12	Unable to obtain. Patient left the Hospital.							Read. Elev.	86 11	M	1.608	P	Not Obtained		Levulose
13	Unable to obtain. Due to immediate operation.							Read. Elev.	123 23	M	1.390	P	Not Obtained		Normal
14	0.026	0.055	0.126	0.074	0.073		0.364 M	Read. Elev. Read.	45 6 54	M	2.105	P	0.364	M	Normal
15	0.056	0.165	0.123	0.34	0.08		0.765 M	Elev.	4	M	2.6	P	0.765	M	Normal
16	0.0632	0.0344	0.0048	0.0024	0.0031	0.0528	0.1607 M	Read. Elev.	113 0	M	1.29	P	0.1607	M	Normal
17	0.252	0.273	0.054	0.0944	0.085	0.0312	0.7896 M	Read. Elev.	96 7	M	2.7	P	0.7896	M	Normal
18	0.108	0.088	0.117				0.323	Read. Elev.	92 14	M	1.283	P	0.323	M	Normal
19	0.348	0.16	0.516	0.168	0.45		1.642 M	Read. Elev.	138 35	M	1.932	P	1.642	M	Normal
20	0.175	0.404	0.356	0.351			1.286 M	Read. Elev.	132 33	P	0.616	P	1.286	M	Levulose
20	0.152	0.115	0.262	0.96	0.255		1.744 M			M	Not Obtained		1.744	M	Levulose
21	Unable to obtain. Patient left the Hospital.							Read. Elev.	109 70	M P	Not Obtained		Not Obtained		Normal
22	0.096	0.33			0.67		1.096 M	Read. Elev.	153 78	P	Unable to void. not obtd.		1.096	M	Levulose
22	0.225	0.08	0.225	0.132			0.662 M	Elev. Elev.	78 78		not obtd. not obtd.		0.662	M	Levulose
23	Unable to obtain. Patient left the Hospital.							Read. Elev.	100 18	M	2.705	P	Not Obtained		Normal
24	1.183	1.32	1.672	2.025	0.8		6.98 P	Read. Elev.	167 0	M	3.256	P	6.98	P	Galactose
25	0.155	0.24	0.208	0.51	0.354	0.528	1.993 M	Read. Elev.	96 9	M	0.0984	M	1.993	M	Normal
26	0.102	0.174	0.175	0.095	0.085	0.125	0.796 M	Read. Elev.	99 16	M	0.0484	M	0.796	M	Normal
27	0.128	0.072	0.333	0.165	0.236	0.096	1.02 M	Not Obtained			1.2	M	1.02	M	Normal
28	1.02	2.08	0.255	0.696	0.688	0.384	5.123 P	Read. Elev.	26 17	M	0.4289	P	5.123	P	Galactose
28	0.575	1.4	1.26	0.27	0.145	0.660 0.340	4.65 P				Not Obtained		4.65	P	Galactose
29	Unable to obtain							Read. Elev.	100 22	M	0.2794	P	Not Obtd.		Normal
30	Unable to obtain, due to difficulty in micturition because of urethral stricture							Read. Elev.	82 11	M	3.03	P	Not Obtd.		Normal
31	0.04	0.648	0.426	0.2	0.1		1.408 M	Read. Elev.	128 25	M	0.652	P	1.408		Normal
32	0.66	0.14	0.468	0.144	0.9	0.48 0.216	2.348 M	Elev.	25		Not Obtained		2.348	M	Normal
32	0.528	0.9	0.912	0.152	0.204	0.222	2.918 P	Read.	123	M	0.792	P	2.818	P	Galactose
		0.416	1.12		0.54		2.076	Elev.	26				2.076	M	
33		0.68	0.16	0.112	0.08	0.09	1.122 M	Read. Elev.	91 9	M	2.032	P	1.122	M	Normal

TABLE II (Continued)

34	0.38	1.12	0.14	0.07	0.04		1.75 M	Read. Elev.	110 29	M	1.219	P	1.75	M	Normal
35	0.136	0.068	0.072	0.028			0.304 M	Read. Elev.	79 5	M	0.39	P	0.304	M	Normal
36	0.275	0.327					0.602 M	Read. Elev.	104 20	M	0.84	P	0.602	M	Normal
37	0.129	0.044	0.056	0.049	0.049		0.327 M	Read. Elev.	96 19	M	2.142	P	0.327	M	Normal
38	0.20	0.408	0.36	0.104	0.0624		1.2224 M	Read. Elev.	121 42	P	1.739	P	1.2224	M	Levulose
39	0.48	1.10	0.4	0.09	0.05		2.12 M	Read. Elev.	136 32	P	1.744	P	2.12	M	Levulose
40	0.63	0.98	0.15	0.144	0.04		1.944 M	Read. Elev.	95 9	M	1.34	P	1.944	M	Normal
41	2.65	0.95	0.21	0.24	0.22		4.27 P	Unable to obtain					4.27	P	Galactose
	0.288	0.464	0.624	0.540	0.462	0.42	2.798 P						2.798	P	Galactose
42	0.276	2.13	0.222	0.830	0.224	0.135	3.817 P	Unable to obtain					3.817		Galactose
	0.880	1.224	0.63	1.32	0.48	0.45	4.984 P	Unable to obtain					4.984	P	Galactose
43	0.69	0.54	0.453	0.0536	0.1254		1.862 M	Read. Elev.	67 2	M	0.12	M	2.372	M	Normal

TABLE III

Case No.	Diagnosis	Treatment	Result
1	Parenchymatous Hepatitis with early Cirrhosis	Medical	Discharged as improved
2.	Pleurisy with Effusion (Left)	Medical	Discharged as improved
3	Hepato—Cellular Jaundice—Gonorrheal keratoderma	Medical	Discharged as improved
4	Hysterical Vomiting	Medical	Discharged as recovered
5	Pulmonary Tuberculosis—Gastric Carcinoma	Medical	Discharged. No remarks
6	Rheumatic Heart Disease	Medical	Discharged. No remarks
7	Leg Ulcer	Medical	Discharged as improved
8	Carcinoma of Colon	Surgical-Colostomy	Still remains on House Surgical Services
9	Chronic Constipation—Achlorhydria—Possible Cholesterosis	Medical	Discharged. Unchanged
10	Bilateral Striatal Disease—Jaundice (undetermined) Monoplegia	Medical	Discharged. Unchanged
11	Duodenal Diverticulum—Gastric Hemorrhage Acute Parotitis	Medical	Discharged as recovered Acute Parotitis
12	Alcoholic Gastritis—Bronchial Asthma	Medical	Discharged as improved
13	Cholelithiasis	Surgical-Cholecystectomy	Discharged as recovered
14	Rheumatic Heart Disease—Mitral Insufficiency—Auric Fibrillation — Syphilis — Bronchial Asthma	Medical	Discharged. No remarks
15	Hypertensive Heart Disease	Medical	Discharged as improved
16	Myxoedema	Medical	Discharged as improved
17	Myxoedema—Umbilical Hernia	Medical Surgical—Repair of Hernia	Discharged as improved
18	Cholelithiasis	Surgical-Cholecystectomy	Discharged as recovered
19	Chronic Cholecystitis with Cholelithiasis	Surgical-Cholecystectomy	Discharged as recovered
20	Malarial Fever	Medical	Discharged as recovered
21	Deep Phlebitis left lower extremity—Cholelithiasis	Medical	Discharged as recovered
22	Coronary Disease—Bundle Branch Block	Medical	Discharged as improved
23	Hypertensive Heart Disease—Retinal Hemorrhage—Cystitis	Medical	Discharged. No remarks
24	Diabetis Mellitus—Hepatitis—Cerebral Thrombosis—Coronary Disease—Mitral Regurgitation	Medical	Discharged with no remarks
25	Arterio-Sclerotic Heart Disease, Hypertension—Liver Damage	Medical	Discharged with no remarks
26	Chronic Nephritis with Oedema—	Medical	Discharged as improved
27	Cholelithiasis	Surgical-Cholecystectomy	Discharged as recovered
28	Common Duct Stone	Medical Refused Operation	Discharged as improved

TABLE III (Continued)

29	Carcinoma Stomach with Metastasis with marked Gastric Retention—Arterio-Sclerotic Heart Disease	Medical	Discharged as inoperable
30	Arterio-Sclerosis—Cardio-Renal Disease with Hypertension—Syphilis—Urethral Stricture	Medical	Discharged as improved
31	Cholelithiasis	Medical	Discharged as unchanged
		Refused Operation	
32	Carcinoma of Liver	Surgical-Cholecystectomy and exploratory laparotomy	Died (Autopsy confirmatory operative findings)
33	Amebiasis	Medical	Discharged as improved
34	Acute Catarrhal Jaundice	Medical	Discharged as improved
35	Hypo-adrenalinism	Medical	Remains on House Medical Service
36	Hypertensive Cardio-Renal Disease—Syphilis—Mitral Regurgitation—Chronic Myocarditis	Medical	Discharged as improved
37	Chronic Cardio-Renal Disease—Coronary Disease—Syphilis	Medical	Discharged as improved
38	Carcinoma Head of Pancreas—Obstruction Biliary Duct	Surgical Anastomosis Gall Bladder to Pyloric end of Stomach	Discharged as improved
39	Acute Jaundice—Cholesterosis Cholesterin Stone—Cholelithiasis	Medical	Discharged—as left against advice
40	Carcinoma of Liver—Secondary to Colonic Carcinoma	Medical	Remains on House Gastro-enterological Service
41	Diffuse Goitre with Hyperplasia	Surgical Subtotal Thyroidectomy	Discharged as improved
42	Exopthlamic Goitre	Medical	Discharged as unchanged Signed Release
43	Amoebiasis	Medical	Remains on House Gastro-enterological Service

TABLE IV

Cases of Hepatic Dysfunction, Glycogen Formation Evidenced by Levulose or Galactose or Both with Van Den Bergh—Bromsulphalien—Urobilinogen Records and Diagnoses

Case No.	Diagnosis	Levulose mg per 100 cc P or M	Galactose Gm. Output P or M	Van Den Bergh Mg. %	Bromsulphalien % Retention	Urobilinogen
1	Parenchymatous Hepatitis with Early Cirrhosis	M	4.34 P	Less Than 0.2 mgm %	10% end of 10 min. 0 in ½ hour	1.180
2	Pleurisy with Effusion (Left)	M	3.276 P		Not performed	
3	Hepato-cellular Jaundice	18—P M (100 Gm) 39—P	4.49 P 3.83 P 4.4 P	Immed. Dir. Indir. 20 mg.	Not performed	1.100
5	Pulmonary Tuberculosis Gastric Carcinoma	M	2.936		Not performed	
6	Rheumatic Heart Disease	M	4.407 P		Not performed	
7	Leg Ulcer	33—M	6.832 P	Direct Immed.-Neg. Indirect—2 Mg.	Not performed	1.100
11	Duodenal Diverticulum—Gastric Hemorrhage—Acute Parotitis	41—P	M		Not performed	1.300
20	Malarial Fever	33—P	M	Indirect 5 Mg.	Not performed	1.300
22	Coronary Disease—Bundle Branch Block	78—P	M	Dir. Biphas 0.5 Mg. Indir. 0.8 Mg.	20% Retention	Not Performed
24	Diabetes Mellitus—Hepatitis—Coronary Disease—Mitral Regurgitation	M	6.98 P	Indir. .07 Mg.	No retention	Not Performed
28	Common Duct Stone	M	5.123 P 4.65 P	Dir. Mod. Immediate Indirect 19 Mg.	Not performed	1.30
32	Carcinoma of Liver	26—M	2.918 P M	Dir. Immed. Indir. 3 Mg.	20% retention	1.100 P

TABLE IV (Continued)

38	Carcinoma Head of Pancreas	42—P		M	Dir. Immed. Indir. 20 Mg.	Not performed	1.50
39	Acute Jaundice—Cholesterosis—Cholesterin Cholelithiasis	32—P		M	Immed. 10 Mg.	Not performed	1.300
41	Diffuse Goitre with Hyperplasia	M	4.27 2.798	P PM	Dir. Neg. Indir. 0.3 Mg. Ict. Ind. 5	Not performed	1.200
42	Exopthalmic Goitre	M	4.984 3.817	P P	0.2 Mg.	2 Mg. Dose 20% retention	1.20

TABLE V

Conditions in which Levulose alone was Positive			Conditions in which Galactose alone was Positive		
Case No.	Diagnosis	Levulose Mg. Per 100 cc	Case No.	Diagnosis	Galactose Gm Output
		P or M			P or M
			1	Parenchymatous Heptatis with early Cirrhosis	4.34 P M
			2	Pleurisy with Effusion (Left)	3.276 P
			5	Pulmonary Tuberculosis—Gastric Carcinoma	2.936 P M
11	Duodenal Diverticulum Gastric Hemorrhage—Acute Parotitis	41 P	6	Rheumatic Heart Disease	4.407 P
			7	Leg Ulcer	6.832 P
			24	Diabetes Mellitus—Hepatitis—Cerebral Thrombosis—Coronary Disease—Mitral Regurgitation	6.98 P ?
20	Malarial Fever	33 P	28	Common Duct Stone	5.123 P 4.65 P
22	Coronary Disease—Bundle Branch Block	78 P	41	Diffuse Goitre with Hyperplasia	4.27 P 2.798 P M
38	Carcinoma Head of Pancreas Obstruction of Biliary Duct	42 P	42	Exopthalmic Goitre	4.984 P
			32	Carcinoma of the Liver	2.348 M 2.918 P M
39	Acute Jaundice—Cholesterosis Cholesterin Cholelithiasis	32 P			

TABLE VI

Conditions in which both Levulose and Galactose Tests Were Positive

Case No.	Diagnosis	Levulose Mg per 100 cc	Galactose Gm Output
3	Hepato—Cellular Jaundice—Gonorrheal Keratoderma	(50 Gm) 39-P	4.49 P 4.4 P 3.83 P

TABLE VII

Highest Reading Increase of Blood Levulose and 2 hr. Readings Levulosuria and Galactosuria

Case No.	Diagnosis	Blood Levulose Mg. per 100 cc		Levulosuria %	Levulosuria cc	Levulosuria Gm.	Galactosuria %	Galactosuria cc	Galactosuria Gm.
1	Parenchymatous—Hepatitis with early Cirrhosis	P or M L or G G—P	10	0.04	140	0.056	0.4	85	0.34
2	Pleurisy with Effusion (Left)	G—P	24	0.05	150	0.075	2	61	1.22
2	Pleurisy with Effusion (Left)	G—P	24	0.05	25	0.125	2	61	1.22
3	Hepato Cellular Jaundice—Gonorrheal Keratoderma	G—M	39 (50 Gm)	0.9	63	0.567	0.6	228	1.36
				0.5	138	0.69	0.8	236	1.8
				Not performed			0.4	70	0.28
				Not performed			0.8	80	0.64
4	Hysterical Vomiting	Normal	13	0.4	38	0.152	0.5	36	0.18
5	Pulmonary Tuberculosis—Gastric Carcinoma	G—P M	19	0.4	28	0.112	3	30	0.90
6	Rheumatic Heart Disease	G—P	37	0.3	80	0.24	0.3	188	0.564
7	Leg Ulcer	G—M	5 (50 Gm)	0.6	28	0.168	0.3	390	1.17
8	Carcinoma of Colon	Normal	20	0.7	12	0.084	0.5	17	0.085

TABLE VII (Continued)

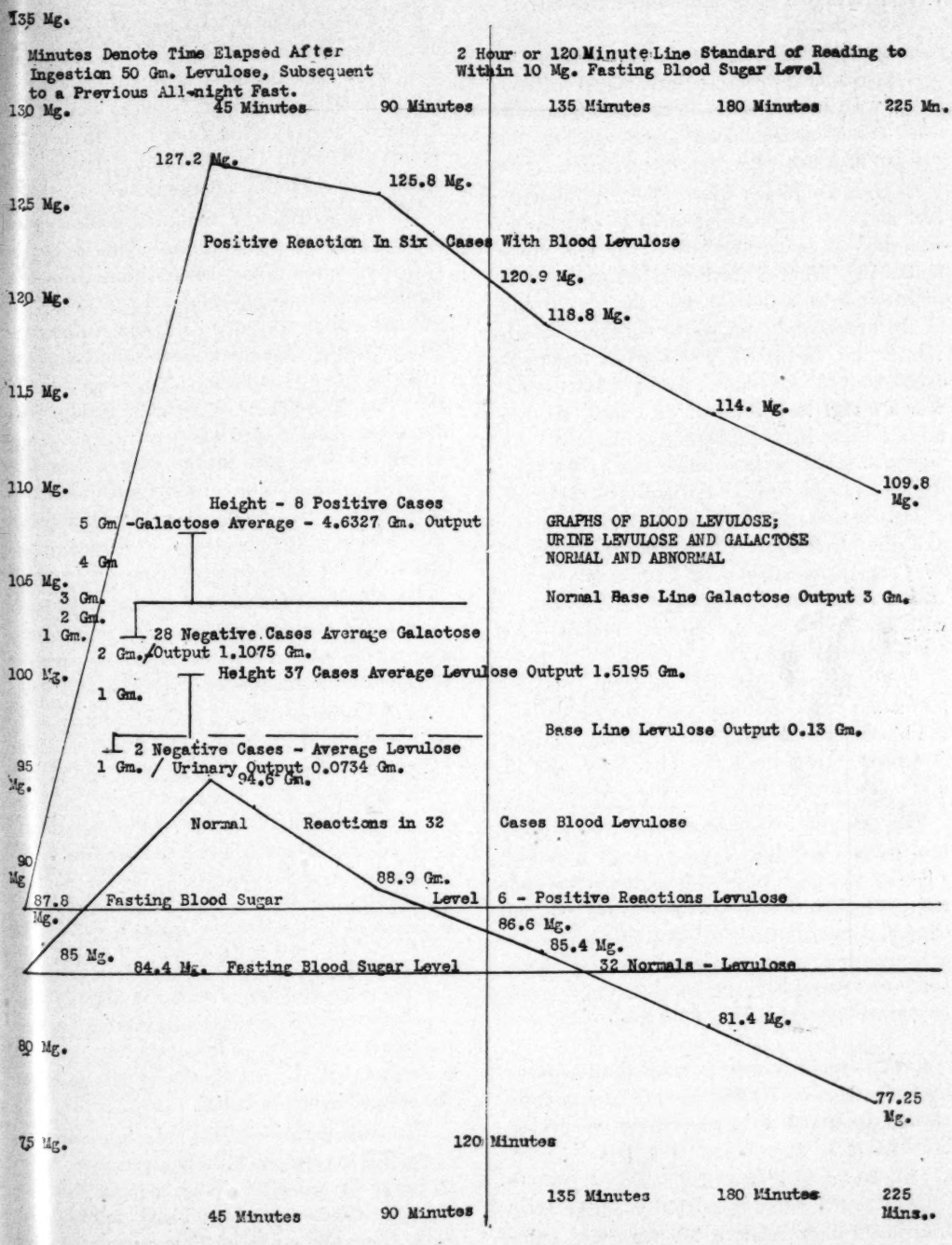
9	Chronic Constipation— Achlorhydria Possible Cholesterosis	Normal	23	0.6	14	0.081	1.4	13	0.172
10	Bilateral Striatal Disease Monoplegia Jaundice (Undetermined)	Not Obtained		0.5	4	0.02	Not Obtained		
11	Duodenal Diverticulum Gastric Hemorrhage—Acute Parotitis	L—P	41	0.5	18	0.09	0.4	48	0.192
12	Alcoholic Gastritis— Bronchial Asthma	Normal	11	0.4	61	0.244	Not Obtained		
13	Cholelithiasis	Normal	23	0.4	58	0.232	Not Obtained		
14	Rheumatic Heart Disease Mitral Insufficiency Auricular Fibrillation Syphilis—Bronchial Asthma	Normal	6	0.3	60	0.18	0.08	158	0.126
15	Hypertensive Heart Disease	Normal	4	0.3	85	0.255	0.25	49	0.123
16	Myxoedma	Normal	0	0.4	122	0.488	0.08	6	0.0048
17	Myxoedma and Umbilical Hernia	Normal	7	0.3	60	0.18	0.3	18	0.054
18	Cholelithiasis	Normal	14	0.5	12	0.06	1.3	9	0.117
19	Chronic Cholecystitis Cholelithiasis	Normal	35	0.4	96	0.384	0.3	172	0.516
20	Malarial Fever	L—P	33	0.4	28	0.112	0.4	89	0.356
							1.0	26	0.262
21	Deep Thrombo—Phlebitis Left Lower Extremity Cholelithiasis	Normal	10	Unable to obtain. No voiding					
22	Coronary Disease—Bundle Branch Block	L—P	78	No Voiding. Unable to obtain			0.5	16	0.08
23	Hypertensive Heart Disease Retinal Hemorrhage—Cystitis	Normal	18	0.3	110	0.33	Unable to obtain. Patient left Hospital		
24	Diabetes Mellitus Hepatitis— Cerebral Thrombosis—Coronary Disease— Mitral Regurgitation	G—P ?	0	0.4	90	0.36	2.2	76	1.672
25	Arterio-Sclerotic—Heart Disease— Hypertension—Liver Damage	Normal	9	0.04	36	0.0144	0.4	52	0.208
26	Chronic Nephritis with Oedema	Normal	16	0.04	12	0.0048	0.5	35	0.175
27	Cholelithiasis	Normal	Not Obtained	0.6	15	0.09	0.09	37	0.333
28	Common Duct Stone	G—P	17	0.25	37	0.0925	0.5	51	0.255
							3.0	42	1.26
29	Carcinoma Stomach with Metastasis with marked Gastric Retention— Arterio-Sclerotic Heart Disease	Normal	22	0.15	29	0.0435	Unable to obtain		
30	Arterio-Sclerosis—Cardio- Renal Disease with Hypertension—Syphilis —Urethral Stricture	Normal	11	0.3	126	0.378	Unable to obtain due to Urethral Stricture		
31	Cholelithiasis	Normal	25	0.4	22	0.08	0.4	105	0.42
							1.3	36	0.468
32	Carcinoma of Liver—Gall Bladder filled with Bile and Pigment	G—P	26	0.5	16	0.08	3.2	35	1.12
				1.2	76	0.912			
33	Amebiasis	Normal	9	0.4	40	0.16	0.8	20	0.16
34	Acute Catarrhal Jaundice	Normal	29	1.4	30	0.42	0.6	24	0.14
35	Hypo-Adrenalinism—Addison's Disease	Normal	5	0.5	40	0.2	0.06	120	0.072
36	Hypertensive Cardio-Renal Disease—Syphilis—Mitral Regurgitation—Chronic Myocarditis	Normal	20	0.5	40	0.84	0.3	109	0.327
37	Chronic Cardio-Renal Disease Coronary Disease—Syphilis	Normal	19	0.3	150	0.45	0.4	140	0.056
38	Carcinoma Head of Pancreas— Obstruction of Biliary Duct	L—P	42	0.7	45	0.225	1.2	30	0.36
39	Cholelithiasis—Acute Jaundice Cholesterosis with Cholesterin Stone	L—P	32	0.3	90	0.27	0.2	200	0.4
40	Carcinoma of Liver Secondary to Colonic Carcinoma	Normal	9	0.4	32	0.128	0.6	25	0.15
41	Diffuse Goitre with Hyperplasia	G—P	Unable to obtain blood or urine				0.5	31	0.21
							0.4	156	0.624
42	Exopthalmic Goitre	G—P	Unable to obtain blood or urine				0.6	37	0.222
							1.8	35	0.63
43	Amebiasis	Normal	2	0.4	30	0.12	0.3	151	0.453

The graphic comparative recordance of results obtained with levulose and galactose as test media showed that:

At 45 minutes 6 positive responses to levulose estimated as blood levulose rose 39.4 mg. above the fasting level. (Average response).

At 90 minutes 6 positive cases dropped from the fastigium 1.4 mg.

At 135 minutes 6 positive cases


135 Mg.
Minutes Denote Time Elapsed After Ingestion 50 Gm. Levulose, Subsequent to a Previous All-night Fast.
2 Hour or 120 Minute Line Standard of Reading to Within 10 Mg. Fasting Blood Sugar Level
130 Mg.
45 Minutes
90 Minutes
135 Minutes
180 Minutes
225 Mn.
127.2 Mg.
125.8 Mg.
125 Mg.
Positive Reaction In Six Cases With Blood Levulose
120.9 Mg.
120 Mg.
118.8 Mg.
115 Mg.
114. Mg.
110 Mg.
109.8 Mg.
Height - 8 Positive Cases
5 Gm. -Galactose Average - 4.6327 Gm. Output
GRAPHS OF BLOOD LEVULOSE; URINE LEVULOSE AND GALACTOSE NORMAL AND ABNORMAL
4 Gm
105 Mg.
3 Gm.
Normal Base Line Galactose Output 3 Gm.
2 Gm.
1 Gm.
28 Negative Cases Average Galactose
2 Gm. Output 1.1075 Gm.
100 Mg.
Height 37 Cases Average Levulose Output 1.5195 Gm.
1 Gm.
Base Line Levulose Output 0.13 Gm.
2 Negative Cases - Average Levulose
1 Gm. Urinary Output 0.0734 Gm.
95 Mg.
94.6 Gm.
Normal Reactions in 32 Cases Blood Levulose
90 Mg
88.9 Gm.
87.8 Fasting Blood Sugar Level
6 - Positive Reactions Levulose
Mg.
86.6 Mg.
85.4 Mg.
85 Mg.
84.4 Mg. Fasting Blood Sugar Level
32 Normals - Levulose
81.4 Mg.
80 Mg.
77.25 Mg.
75 Mg.
120 Minutes
135 Minutes
180 Minutes
225 Mins.
45 Minutes
90 Minutes

dropped from 90 min. level 6.2 mg.

At 180 minutes 6 positive cases dropped from 135 min. level 4.8 mg.

At 225 minutes 6 positive cases dropped from 180 min. level 5.2 mg. and remained 22 mg. above the fasting blood sugar level of 87.8 mg.

In contrast to the above linearly depicted rise and fall in blood levulose by 6 positive reactors—32—normals rose ten and two-tenths mg. from a fasting blood sugar level of 84.4 mg. to a level of 94.6 mg. at the end of the first 45 minutes, at 90 minutes the fall (from the fastigium attained in excursus subsequent to ingestion of 50 mg. of levulose), was 5.7 mg. to a level of 88.9 mg. At 135 minutes the curves (average) dropped 4.5 mg. to 85.4 mg. or to within 1 mg. of the fasting blood sugar, but at 120 minutes, the limit of observation of Tallerman, Joliffe and Kendall, the blood sugar curve reached a level of 86.6 mg. or at a level but 2.6 mg. above the fasting blood sugar, which is in agreement with their views as to normal reaction. At 180 minutes a drop from 85.4 mg. to a level of 81.4 mg. or of 4 mg. had occurred. At 225 minutes, or the end of period of observation, the blood levulose level was 77.25 mg., a drop of 4.15 mg. from the 180 minute level, or 7.15 mg. below the fasting blood sugar level.

The average galactose elevation in 8 positive cases above the 3 gm. output line was 1.6327 gm. to a level of 4.6327 gm. total output, while the negative responses in 28 cases showed a total output of but 1.1075 gm.

The average levulosuric output in 37 positive cases was 1.5195 gm. and in the 2 negative reactions was 0.0734 total gm. output.

RESULTS

I. The contrastively portrayed tabulations of tables Nos. I, II, IV, V and VI are sufficiently apparent as to necessitate no further elucidation.

II. The depiction of Table No. VII solely illustrates the non-dependability of the levulosuric findings relative to per cent, cubic centimeters of output and gm. total output as indicative of decreased hepatic glycogen function, as in only two of the forty-three cases tested was the output below 0.13 gm.

CONCLUSIONS

I. A dose of fifty (50) gm. of levulose or forty (40) gm. of galactose after an overnight fast, is, in each instance, adequate to effect a valid variation of blood levulose and urine galactose portrayal as compared to the excursus evinced by the blood and urine of normals, after a similar ingested dose of each.

II. From Table V the incidence of positivity of levulose or galactose alone is as five (5) is to seven (7). In addition galactose, manifests three questionably positive reactions, which if added to the antecedent seven, would render the comparative positivity as five (5) is to ten (10), or as one (1) is to two (2). The case number twenty-four diagnosis diabetes mellitus presenting a galactosuria of 6.98 gm. output with a negative blood levulose was discarded from consideration because the reactions were not dependable, owing to the perversion of carbohydrate action by the disease entity evinced.

III. Table VI portrays an equal decrease in hepatic glycogen function by both tests, and is the only case with duality of reaction by investigative agents.

IV. Unexpectedly positive evidences of mitigation of hepatic glycogen function were evinced in Cases Nos. II, VII, XLI and XLII, with galactose as a research agent; and in Case No. XI with levulose as the test sugar.

V. There seems to be no parallelism in reaction between levulose or galactose as test sugars, in any case or type of case save that manifested in Case No. 3, Table VI.

Therefore, it is concluded that in estimating the degree of impairment of hepatic glycogen function of any patient, should one test be negative, it becomes imperative to perform the other, but if one is positive, exhibition of the second is non-essential.

VI. Comparatively, the galactose test presents the greater ease of performance, as it is easier to collect urinary output hourly, than to effect numerous blood extractions, both from the point of time consumed and discomfort experienced by the patient; and, since each separate specimen examined sub-

sequent to the ingestion of galactose, showed the presence of this sugar, all specimens, after the fasting one, can be estimated for galactose content from a total admixed specimen, thus saving much time in estimating the total gm. output.

Arrayed against such is the probably greater exactitude of blood levulose determinations as contrasted with the fact that the elimination of urine may not be expressive of the complete evacuation of the patient's bladder.

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CANCER COMMENT
Malignant Tumors of the Thyroid

MARION L. H. FREEMAN*

Although cancer of the thyroid is seen relatively rarely by physicians in general practice, it is found fairly frequently in clinics at which numerous patients with thyroid disease are treated. Lahey, [S. G. & O., **56**, 418, (Feb. 15), 1933] reports an incidence of 2.86% in 6,535 patients operated upon for thyroid disease at the Lahey Clinic, while 1.2% to 10% has been quoted by various other authors. There seems to be a definitely higher incidence in the so-called goitrous areas.

About twice as many women as men are affected. This corresponds to the sex ratio in endemic goitre. The majority of cases are found in persons in the fifth decade of life.

The clinical differentiation between malignant and benign tumors of the thyroid is extremely difficult and in most cases impossible. There are relatively few clinical findings by which early malignancy of the thyroid can be detected, although marked firmness and fixation of an adenoma or sudden rapid growth of a tumor of long standing should be regarded as a very suggestive symptom. The prophylactic measure of removing adenomas while they are benign is the one hope for clinical control of this condition, since statistics show that nearly 80% of the malignancies arise in pre-existing adenomas.

The careful pathological examination of all tissue removed at operation plays a very important part in the diagnosis. Six per cent of the supposedly benign adenomas examined at the Lahey Clinic showed malignant changes.

Cases which are not recognizable clinically but are diagnosed by the pathologist after the removal of presumably benign adenomas are most amenable to therapy. In these cases, where the entire tumor has been removed surgically, the prognosis is very favorable.

Since malignant growths of the thyroid show a peculiar tendency to produce distant metastases by extending through and into the blood vessels, many operators advise the use of the electric cutting current for removing these growths, contending that the blood vessels are sealed at the time of removal, thus eliminating this danger. The tendency to

*Secretary-technician, Delaware Tumor Clinics.

spread in this manner has prevented several authors from removing biopsies for diagnosis, but others claim that if the cautery is used there is no appreciable difference in the prognosis. Statistics regarding these opinions are not convincing.

The clinically, frankly malignant thyroid tumor usually carries with it a prognosis of early death. In these cases radium and x-rays have proved very beneficial as palliative treatment, and among a comparatively small group of patients studied there is a report of cures of 10% of a series of cases considered primarily inoperable. Surgical intervention offers little aid in the rapidly growing and extending types and an early recurrence can be expected if this form of treatment is used.

These tumors simulate tumors of the breast and prostate in their predilection for metastasis to bone—Levin (Amer. Jour. Path., 6,563, 1930) urges that the thyroid be considered along with the breast or prostate in attempting to locate the primary site in patients with extensive metastatic bone involvement of unknown origin. Metastatic lesions in the lung, adrenal, ovary, and brain have been reported.

There are five cases of malignant thyroid disease in the files of the Delaware Tumor Clinics. The first: a white female, aged 55 years, had a swelling of the neck with cough and nervousness in 1931. At this time the basal rate was normal. A subtotal thyroidectomy was done and a diagnosis of adenocarcinoma was made. The patient remained well for about two and one-half years and then developed metastases to the abdominal cavity and cervical lymph nodes. A biopsy of a cervical node was diagnosed as adenocarcinoma, metastatic from the thyroid, at this time.

The second, a white male, aged 47 years, had noticed a slight swelling of the neck for a long period of time, but this had given him no trouble until six weeks previous to the time when he presented himself at the tumor clinic. The swelling had been increasing rapidly during this time and had been aspirated twice with no results. On examination a firm mass 8 cm. in diameter was found over the lower pole of the thyroid. This moved with swallowing. The skin was red and shiny, but there was no ulceration. The patient complained of cough and choking sensation, loss of twenty pounds weight in six weeks, and had a basal rate of +49. X-ray showed numerous metastatic nodules in the lungs. A cycle of x-ray therapy to the tumor and lungs was started, but because of the critical condition of the patient this was discontinued after two treatments, and the patient expired two days later or three months from the time of noticeably rapid growth of the tumor. A partial necropsy was performed and a diagnosis of neurogenic sarcoma made.

The third, a white female, aged 44 years, had been advised "not to bother" with a lump in the right side of her neck, first noticed three years previous to admission for surgery. A slightly nodular mass was removed and a diagnosis of carcinoma of the thyroid made. Two cycles of x-ray therapy were given; the first one month post-operative, and the second one year later, when a small nodule appeared near the scar. The patient presents no symptoms at this time, four years after the first symptom.

The fourth, a white female, aged 52 years, presented sudden symptoms of hyperthyroidism eleven months previous to first lobectomy. Five months later the remaining lobe was removed and an unsuspected carcinoma 1 cm. in diameter was found embedded in the hyperplastic thyroid tissue. At this time, almost two years from the date of operation, the patient is still living. No irradiation treatment has been given. The site of the tumor is hard and irregular, giving the appearance of an enlarged thyroid. X-ray irradiation will be tried for palliative effect.

The fifth, a white female, aged 34 years, gave a history of enlargement of the thyroid with a basal rate of +57 ten years previous to subtotal thyroidectomy at which time a diagnosis of benign adenoma was made. Symptoms had been severe only at menstrual periods and during pregnancy. Because of a persistent mass in spite of basal rate of +5 an incision was made and 20 grams of tissue removed. A diagnosis of slowly growing carcinoma of the thyroid was made. A cycle of x-ray treatment consisting of 3500 r to the neck, given over a period of four weeks, was completed less than eight weeks after removal of the tumor, and another cycle will be given after the skin reaction has entirely subsided.

EDITORIAL

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Dover in Retrospect

The one hundred and forty-fifth annual session of the Medical Society of Delaware has passed into the record of things accomplished. It was in every sense a very successful meeting. In the first place, the work required of the House of Delegates was minimal, was put through with neatness and dispatch, and was characterized by an exceptional degree of harmony.

In the second place, the scientific meetings were very well attended, the papers were of better than average quality, the discussions showed liberality without verbosity, and once again we can record a one hundred per cent attendance of the speakers scheduled to appear.

In the third place, the general public meeting was a success, despite the facts that it was held in a down-state town and was arranged for on relatively short notice. The guest speakers at this meeting presented unusually interesting addresses.

Finally, the social functions and general atmosphere were extremely pleasant and enjoyable. The officers and committees responsible for the session are to be congratulated. The physicians who attended—two-thirds of our whole membership—rendered themselves a profitable service.

The Chicago Conference

The annual conference of secretaries of the state medical societies and editors of the state medical journals, under the auspices of the home office of the American Medical Association, was held at the Palmer House, Chicago, September 21 and 22, 1934. Dr. Robert L. Parker, of Des Moines, was elected chairman. A varied, interesting and instructive program was presented, as follows:

Call to Order. J. H. J. Upham, Chairman of the Board of Trustees of the American Medical Association.

The Medical Society of New Jersey Experiments in Furnishing Medical Services in the Community. LeRoy A. Wilkes, Executive Secretary of the Medical Society of New Jersey.

The Centralization and Departmentalization of State Medical Society Activities. Oliver J. Fay, Chairman of the Board of Trustees of the Iowa State Medical Society.

The Work of the Committee on Mental Health. H. Douglas Singer, Chairman of the Committee on Mental Health of the American Medical Association.

Address. James S. McLester, President-elect of the American Medical Association.

Medical Emergency Relief. Holman Taylor, Secretary of the State Medical Association of Texas; William C. Woodward, Director of the Bureau of Legal Medicine and Legislation of the American Medical Association.

Some Problems of a State Medical Editor. W. Edwin Bird, editor of the Delaware State Medical Journal.

Address. R. L. Sensenich, member of the Committee on Legislative Activities of the American Medical Association.

The Educational Possibilities of Scientific Programs at State and County Meetings. Clyde L. Cummer, President of the Ohio State Medical Association.

Health Insurance in England and Medical Plans in the United States. R. G. Leland, Director of the Bureau of Medical Economics of the American Medical Association.

Since these papers will be published in the *Bulletin of the A. M. A.* we shall refrain from

comment at this time, except to say that it is apparent that the A. M. A. headquarters is on its toes and is functioning indefatigably in the interests of the profession. Incidentally, in connection with the Doctors Decalogue, adopted at the Cleveland convention last June, it was pointed out that at least three county medical societies (Alameda and San Diego Counties, California, and Wayne County, Michigan) have evolved plans for the care of the indigent and small income classes that surpass any of the compulsory health insurance plans of Europe. Every physician should digest these new plans, for which see the *Journal of the A. M. A.*, September 8, 22, and 29, 1934.

For the benefit of those meticulous souls who want to do things just so we would offer the reminder that there is no such organization as the "Delaware State Medical Society." For the 145 years that the profession of this state has been organized its only legal and correct name has been the "Medical Society of Delaware."

Again we make a plea for hospital news and items that concern the profession. As compared with the other state journals we are pointedly deficient in this respect.

The Woman's Auxiliary to the A. M. A. now issues their *News-Letter* as a quarterly instead of a monthly. We are frank to state we miss the monthly; we wish they could find their way clear to go back to the monthly, even though it be reduced in size. The news then comes fresher, and we can use more of it. We would like to give the Auxiliary a full page each issue, and the local news rarely provides that much.

Don't forget the International Medical Assembly to be held in the Municipal Auditorium, Philadelphia, the week of November 5th. Next to the annual convention of the A. M. A. itself, this Assembly is the largest medical meeting in the world. A splendid program has been prepared with, as always, the emphasis placed on practical instruction. With such a meeting so near to us, we hope many Delaware physicians will avail themselves of the opportunity to attend.

MISCELLANEOUS

International Assembly

The first International Assembly of the Inter-State Post-Graduate Medical Association of North America to be held east of the Alleghenies is to take place in the Public Auditorium of Philadelphia, Pennsylvania, November 5th, 6th, 7th, 8th and 9th, 1934, with pre-Assembly clinics on November 3rd and post-Assembly clinics on November 10th in the Philadelphia hospitals.

The Public Auditorium is located in the University area and across the street from the Philadelphia General Hospital, thus assuring the Assembly close access to the abundance of clinical material.

The aim of the program committee, with Dr. George W. Crile, as chairman, is to provide for the medical profession of North America an intensive post-graduate course covering the various branches of medical science. The program has been carefully arranged to meet the demands of the general practitioner as well as the specialist. Extreme care has been given in the selection of the contributors and the subjects of their contributions.

The Philadelphia County Medical Society will be host to the Assembly and has arranged an excellent list of committees that will function throughout the Assembly. A most hearty invitation is extended to all members of the profession who are in good standing in their State society to be present and enjoy the hospitality of Philadelphia, "The City of Brotherly Love." The list of distinguished teachers and clinicians who are taking part on the program was published last month of the advertising section of The Journal. Special reduced railroad rates will be in effect on all lines.

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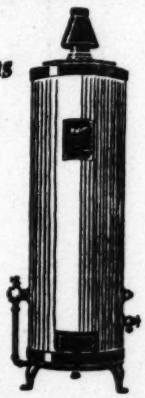

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